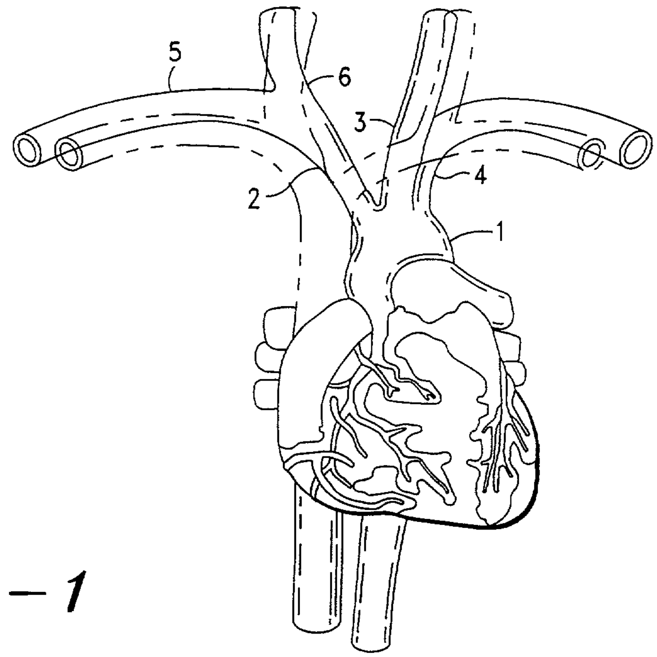


FIG.–1

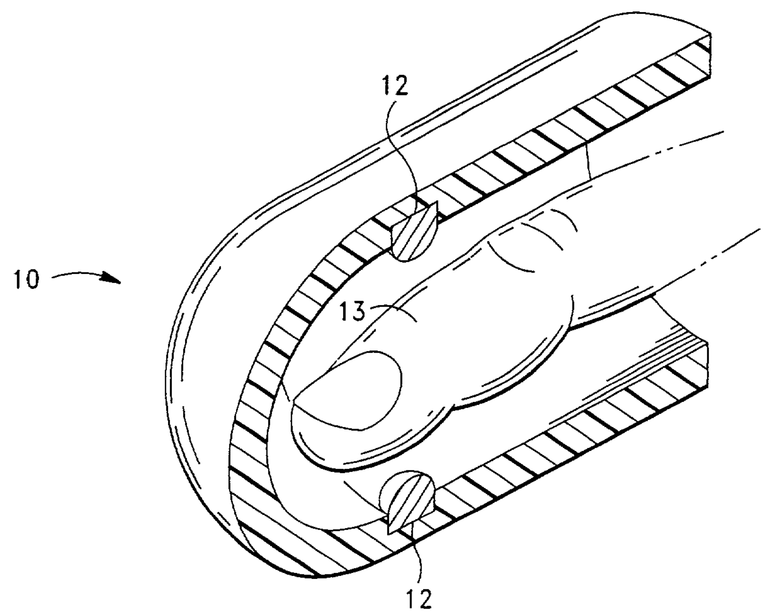


FIG.–2

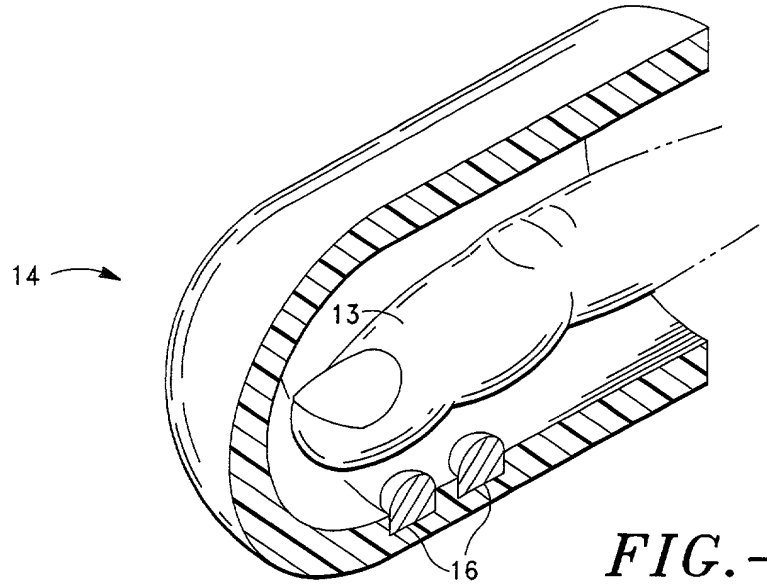


FIG.–3

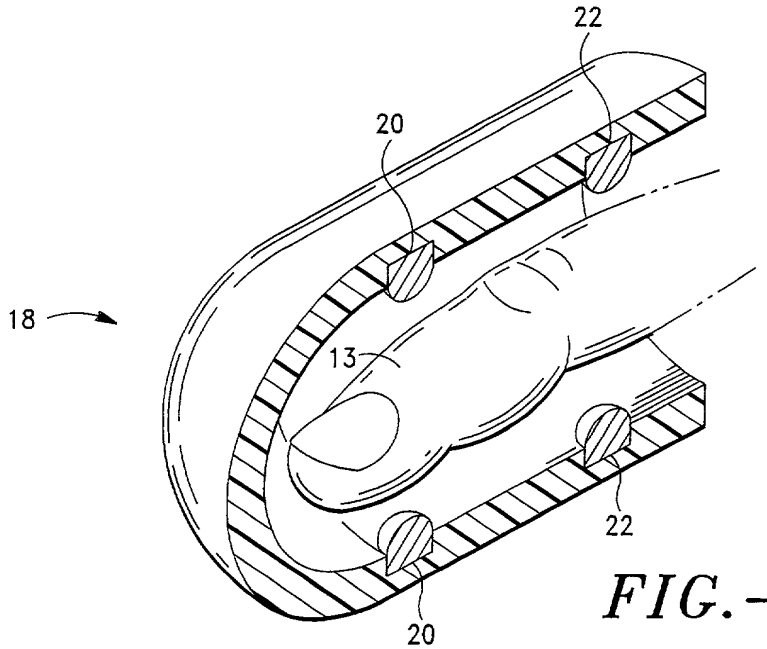


FIG.–4

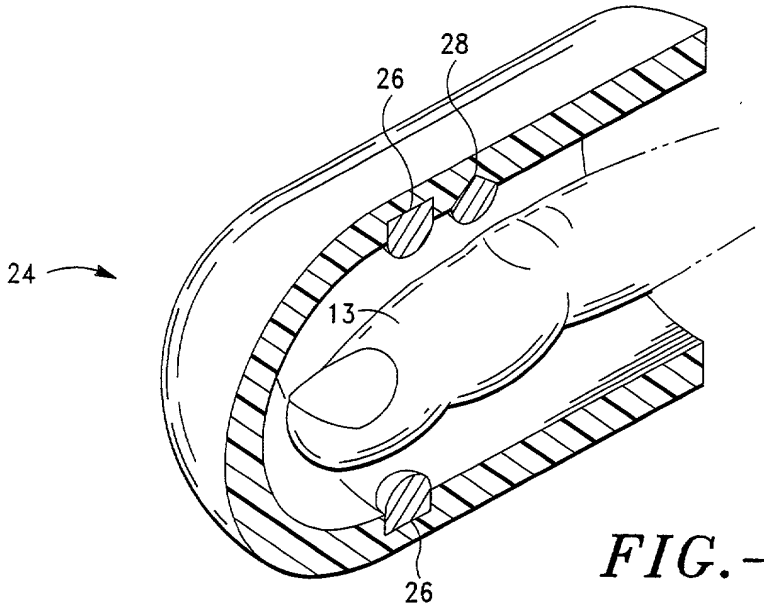


FIG.–5

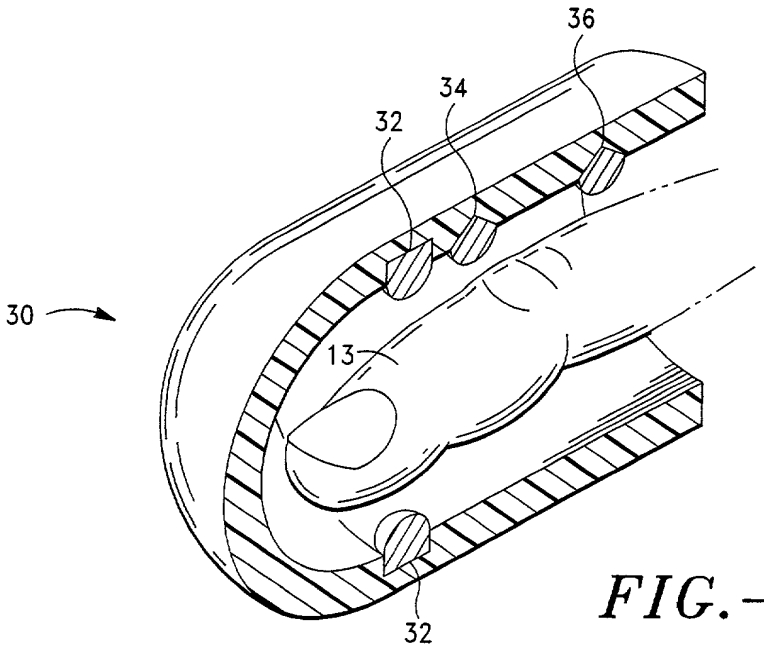


FIG.–6

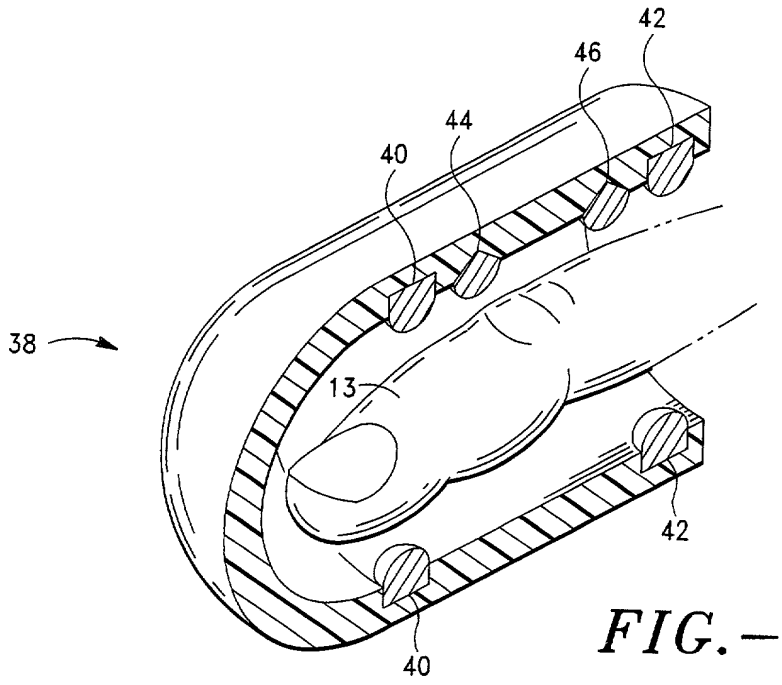


FIG.–7

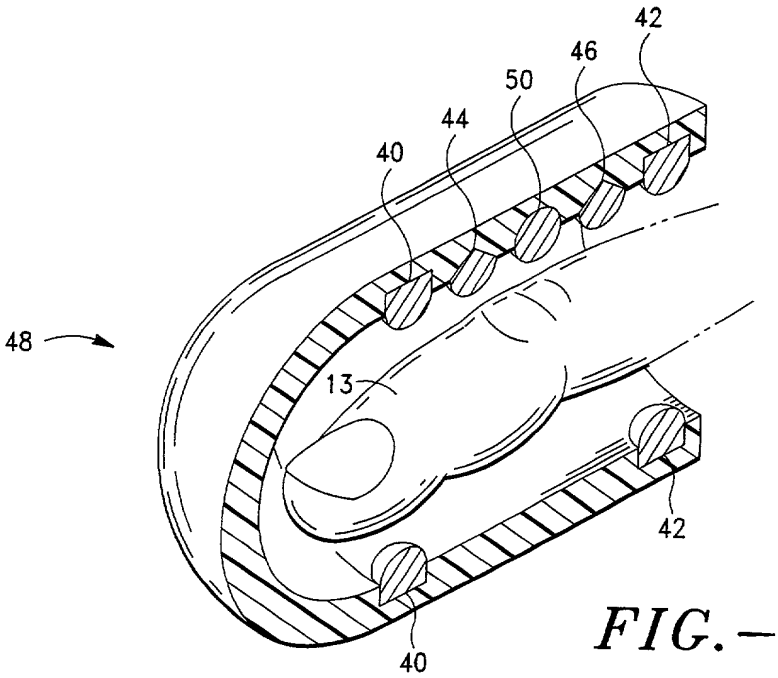


FIG.–8

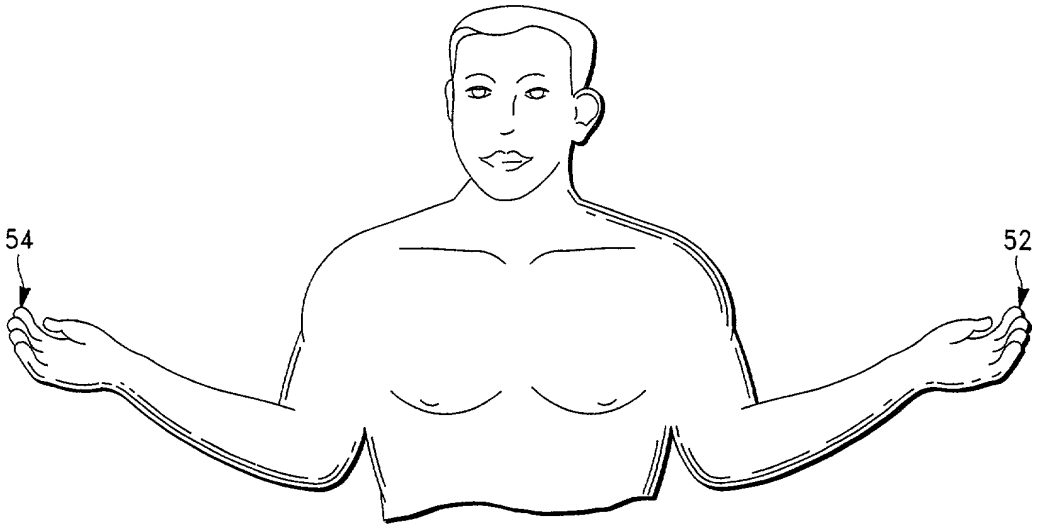


FIG.–9

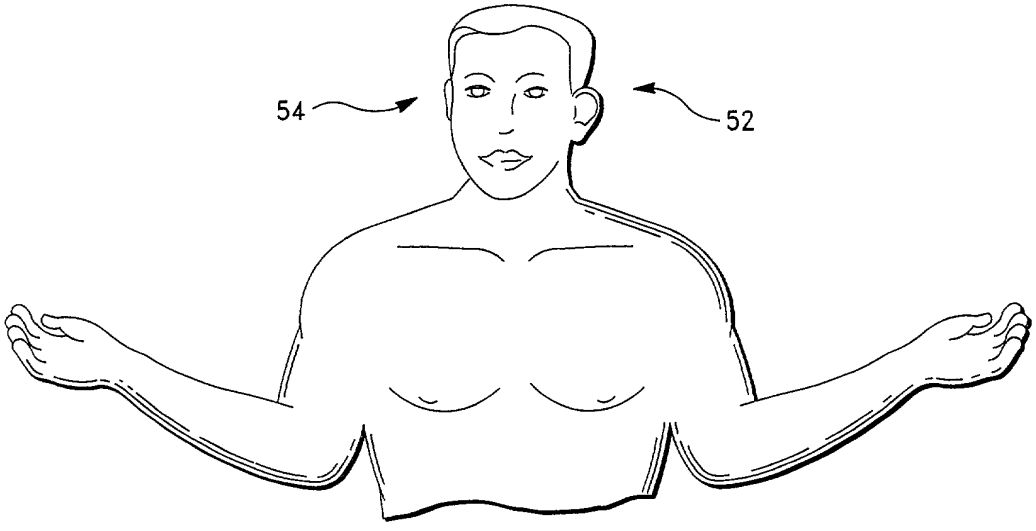


FIG.–10

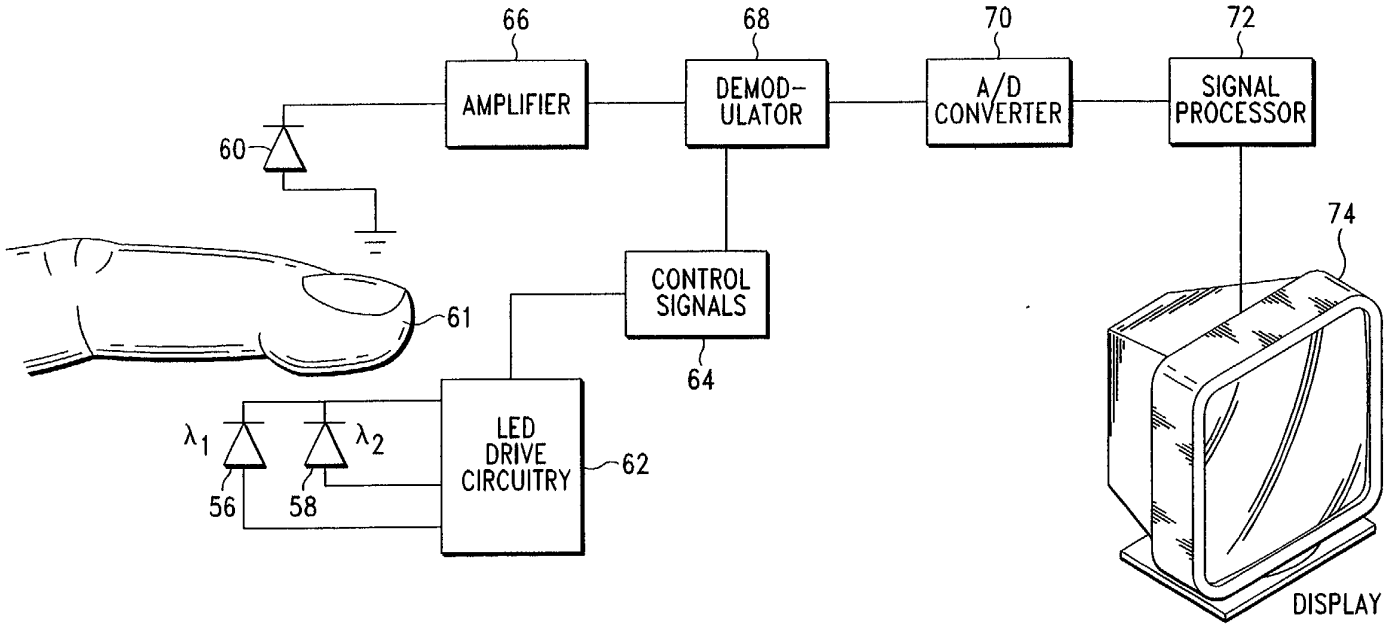

66
68
70
72
AMPLIFIER
DEMOD-ULATOR
A/D CONVERTER
SIGNAL PROCESSOR
60
61
CONTROL SIGNALS
64
74
λ_1
λ_2
LED DRIVE CIRCUITRY
62
56
58
DISPLAY

FIG.–11

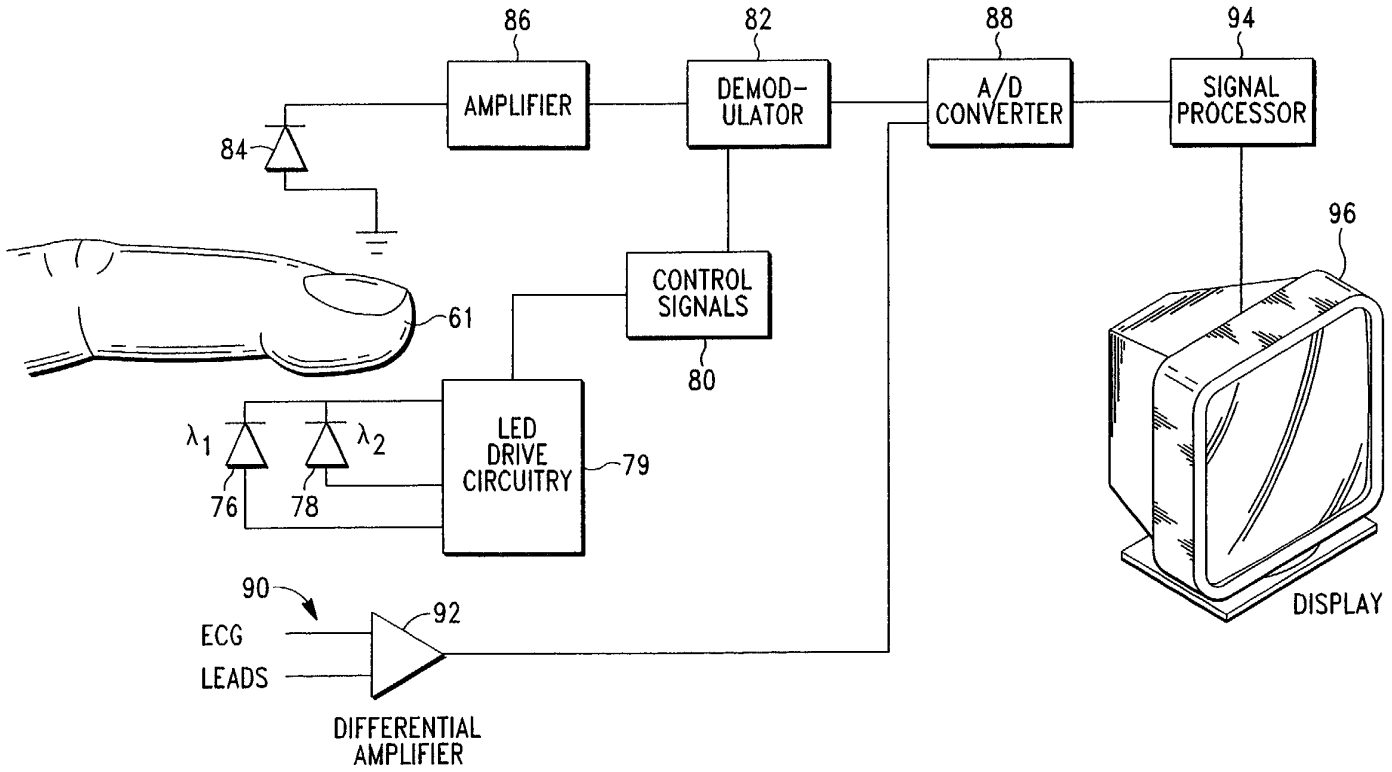

86
82
88
94
AMPLIFIER
DEMOD-
ULATOR
A/D
CONVERTER
SIGNAL
PROCESSOR
84
96
CONTROL
SIGNALS
80
61
λ_1
λ_2
LED
DRIVE
CIRCUITRY
79
76
78
90
92
ECG
LEADS
DISPLAY
DIFFERENTIAL
AMPLIFIER

FIG.–12

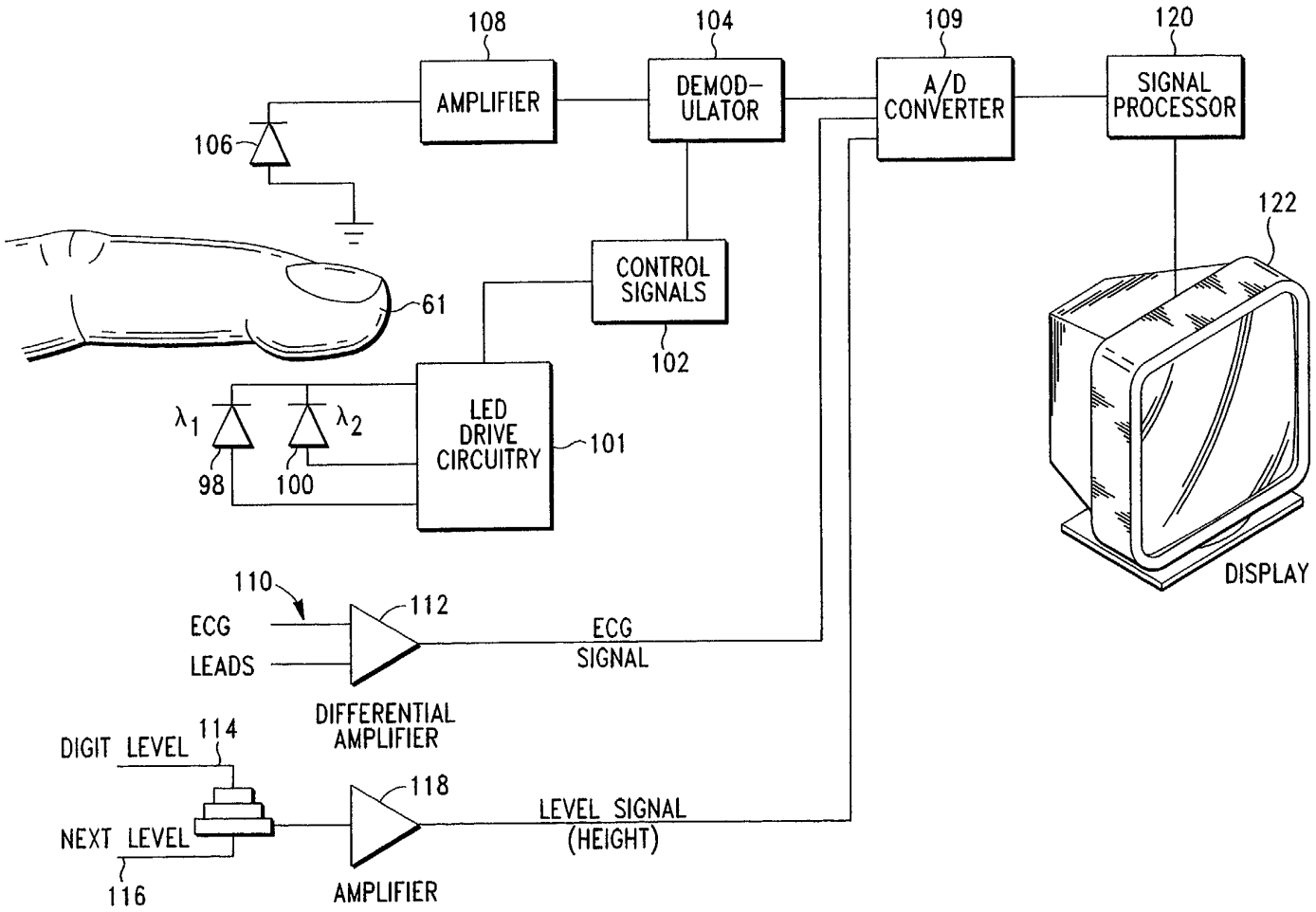

108
AMPLIFIER
104
DEMOD-
ULATOR
109
A/D
CONVERTER
120
SIGNAL
PROCESSOR
106
61
CONTROL
SIGNALS
102
122
λ_1
λ_2
98
100
LED
DRIVE
CIRCUITRY
101
DISPLAY
110
ECG
LEADS
112
ECG
SIGNAL
DIFFERENTIAL
AMPLIFIER
DIGIT LEVEL
114
NEXT LEVEL
116
118
LEVEL SIGNAL
(HEIGHT)
AMPLIFIER

FIG.–13

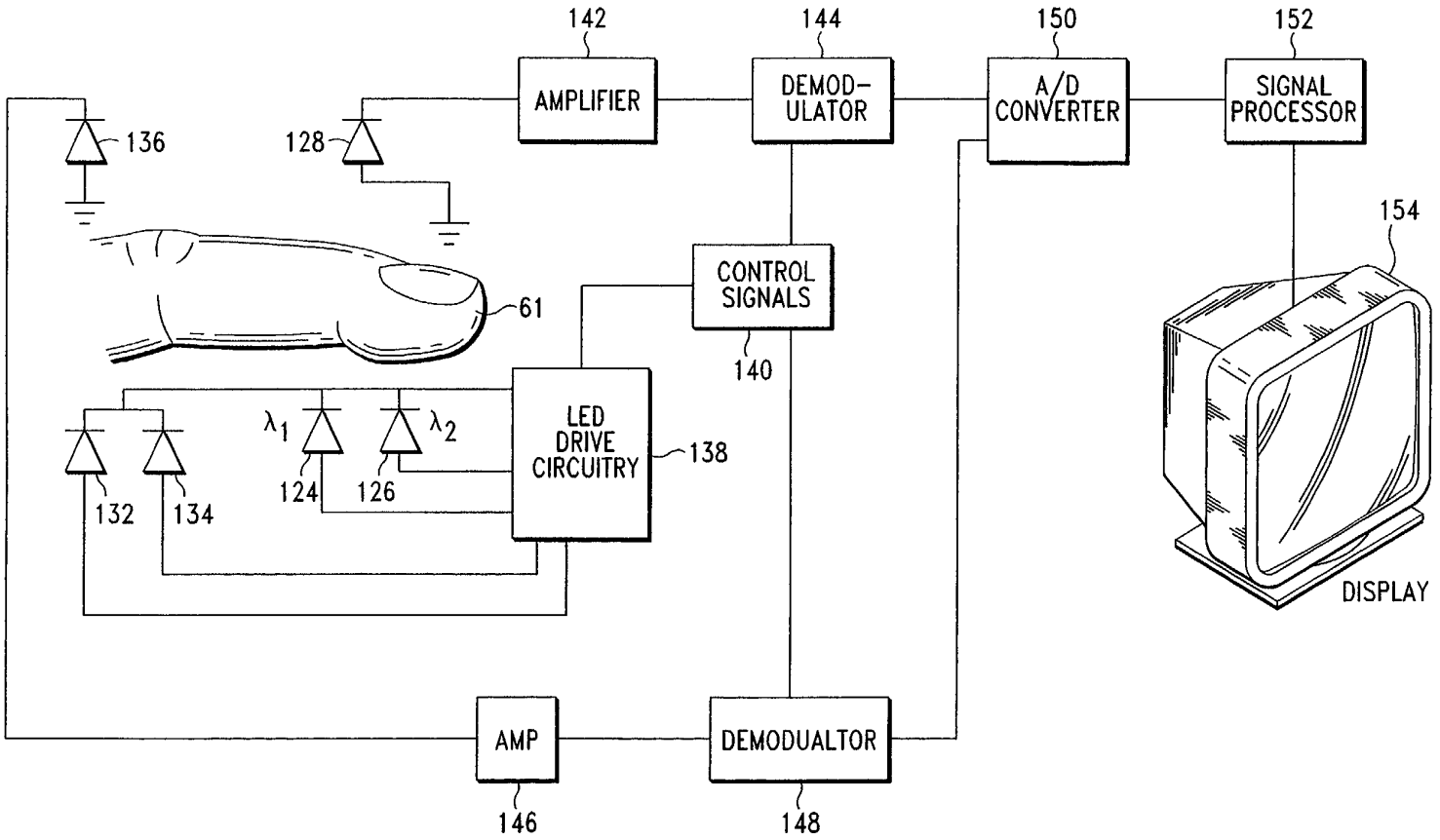

142
144
150
152
AMPLIFIER
DEMOD-ULATOR
A/D CONVERTER
SIGNAL PROCESSOR
136
128
61
CONTROL SIGNALS
140
154
LED DRIVE CIRCUITRY
138
λ_1
λ_2
132
134
124
126
DISPLAY
AMP
DEMODUALTOR
146
148

FIG.–14

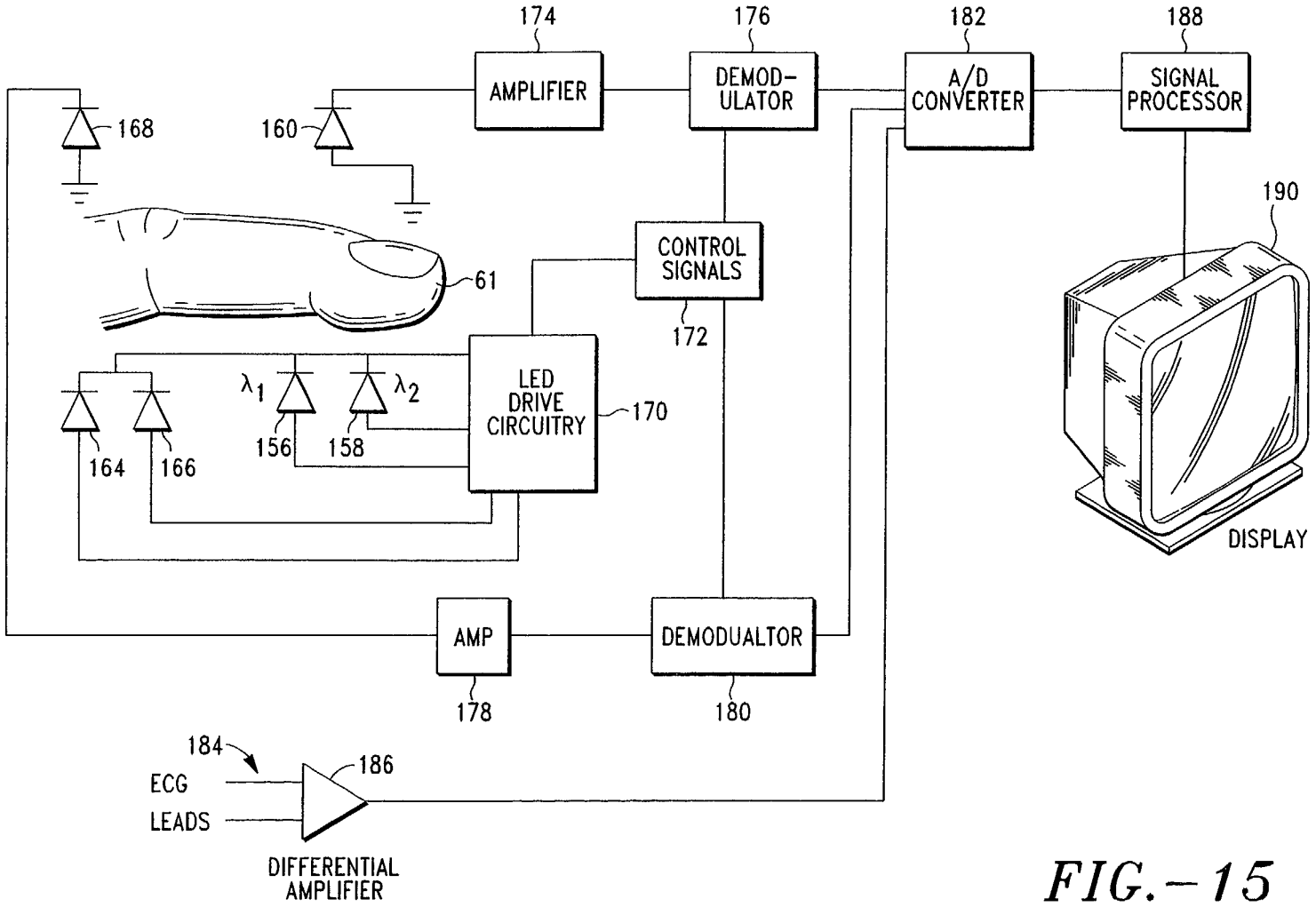

174
AMPLIFIER
176
DEMOD-
ULATOR
182
A/D
CONVERTER
188
SIGNAL
PROCESSOR
168
160
190
CONTROL
SIGNALS
172
61
LED
DRIVE
CIRCUITRY
170
λ_1
λ_2
164
166
156
158
AMP
178
DEMODUALTOR
180
184
186
ECG
LEADS
DIFFERENTIAL
AMPLIFIER
DISPLAY

FIG.–15

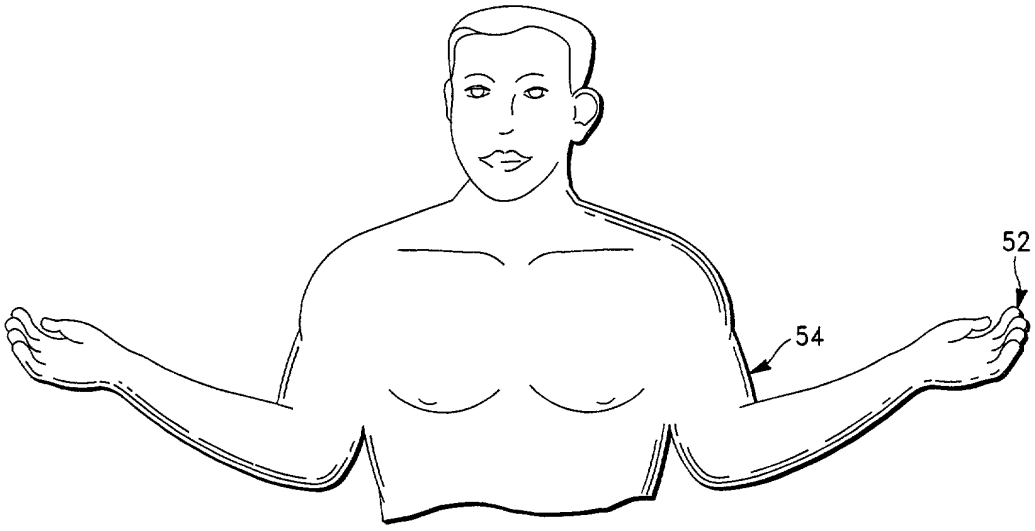


FIG.–16

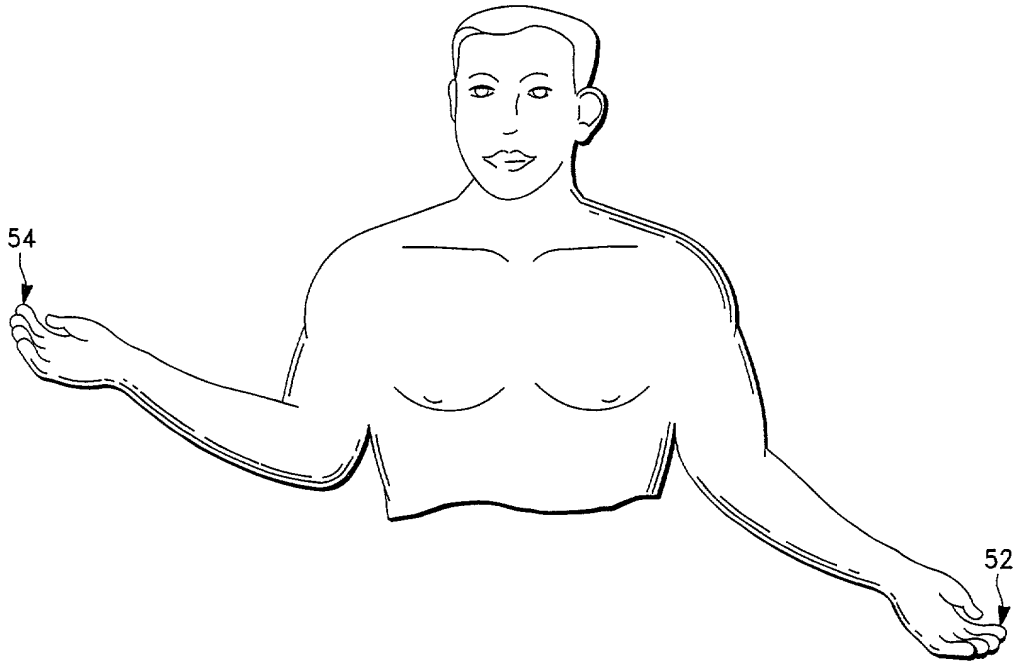


FIG.–19

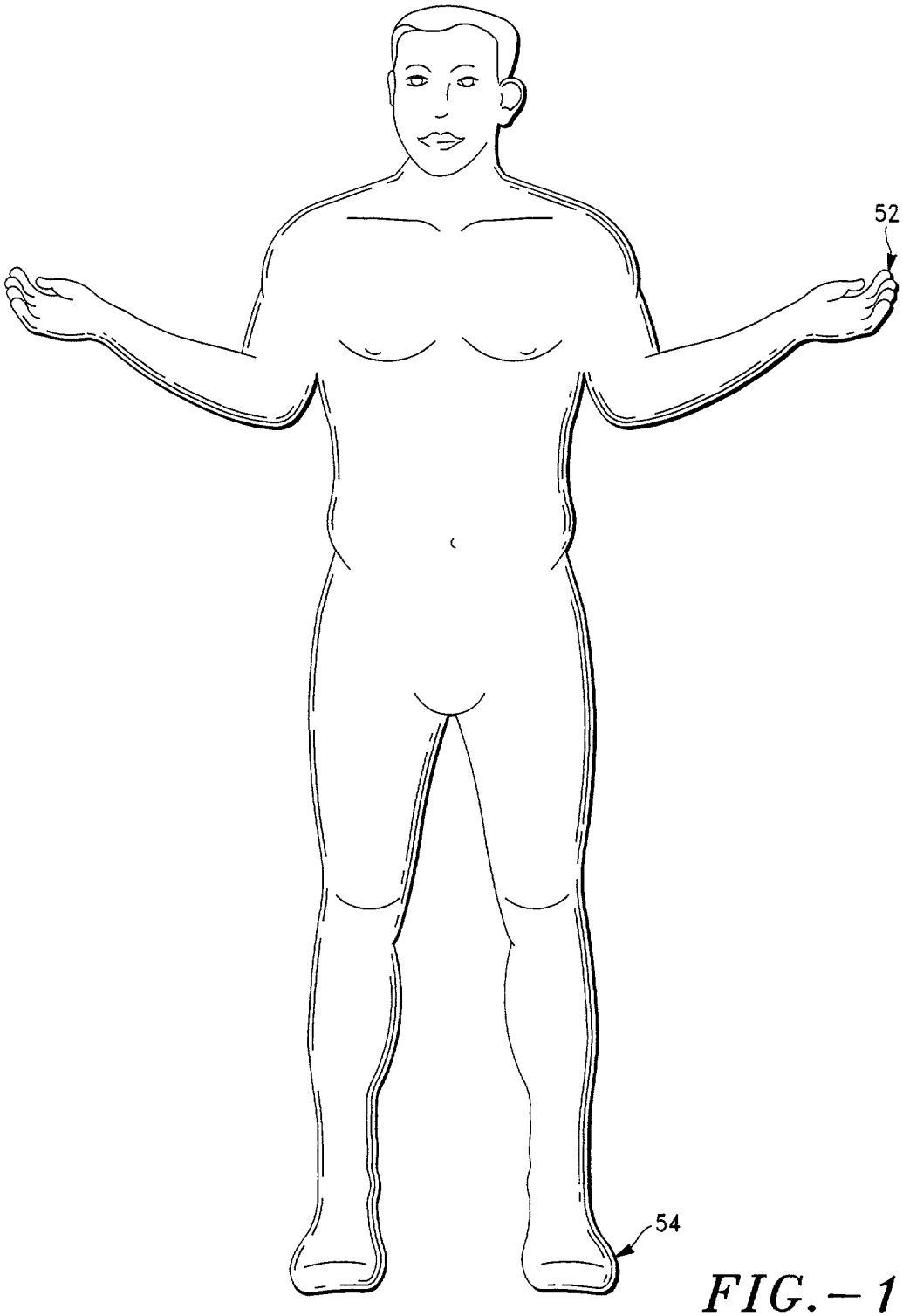


FIG.–17

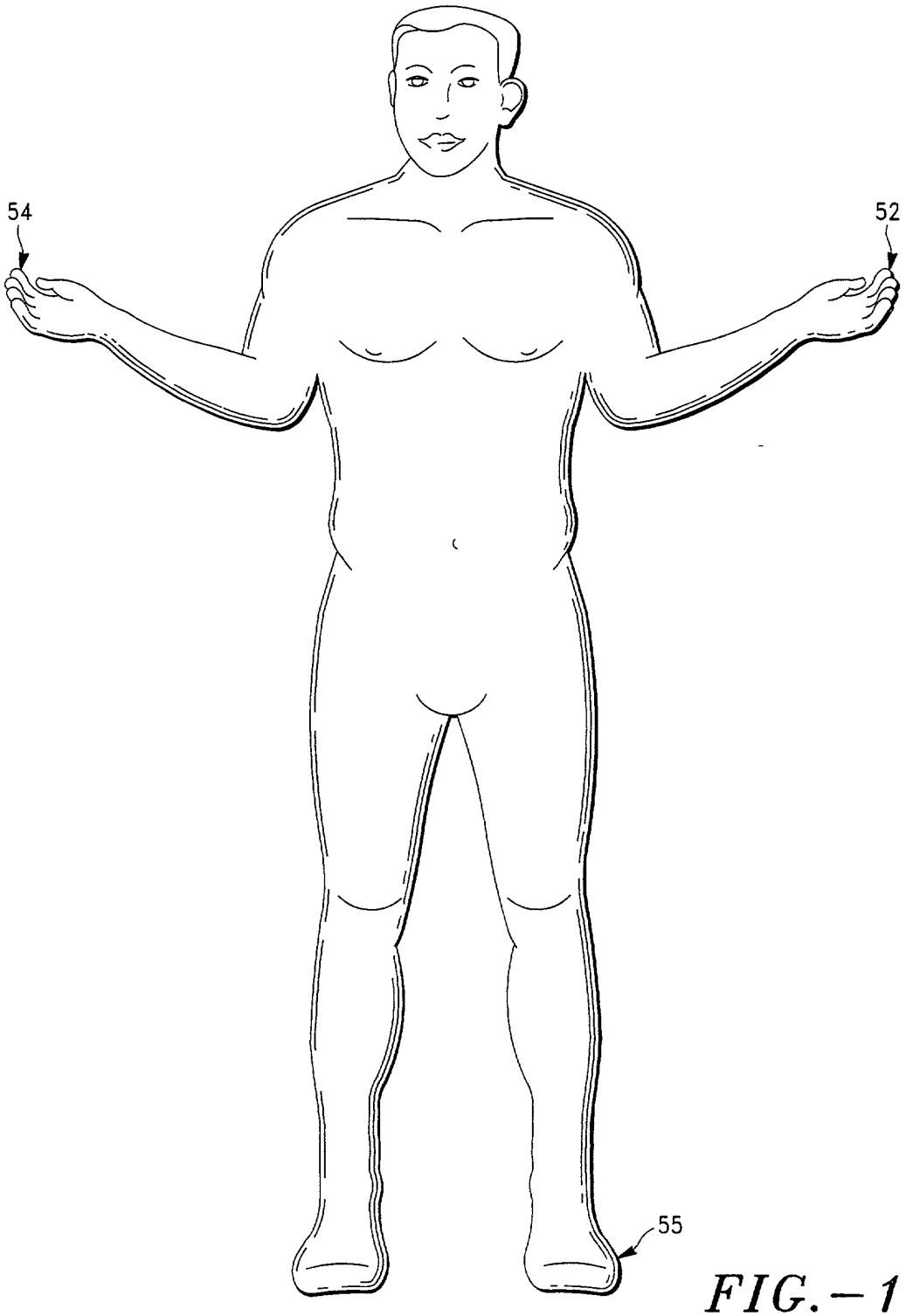


FIG.–18

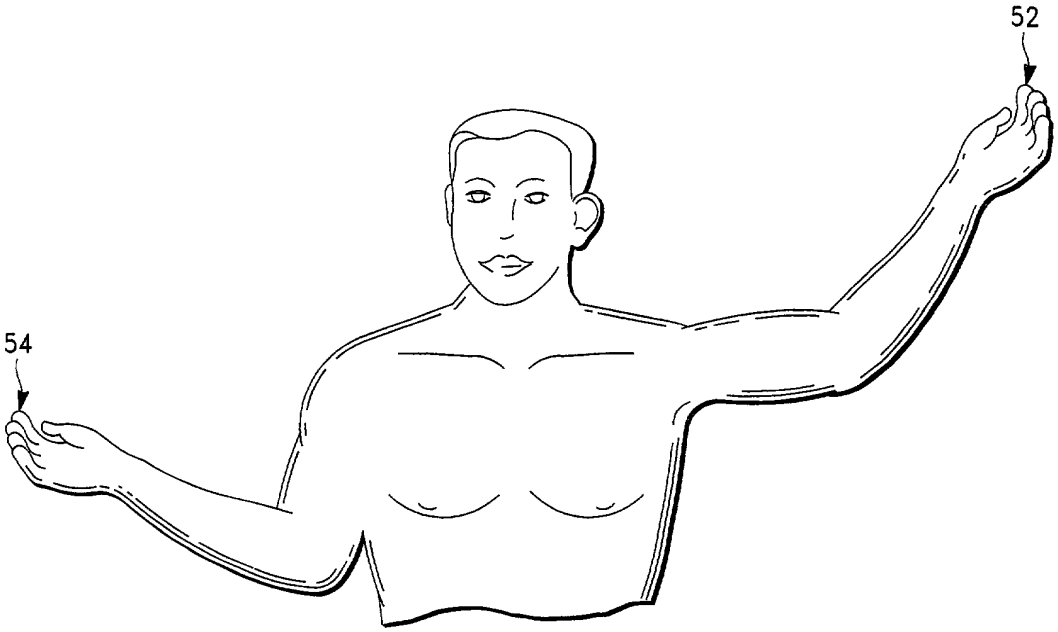


FIG.–20

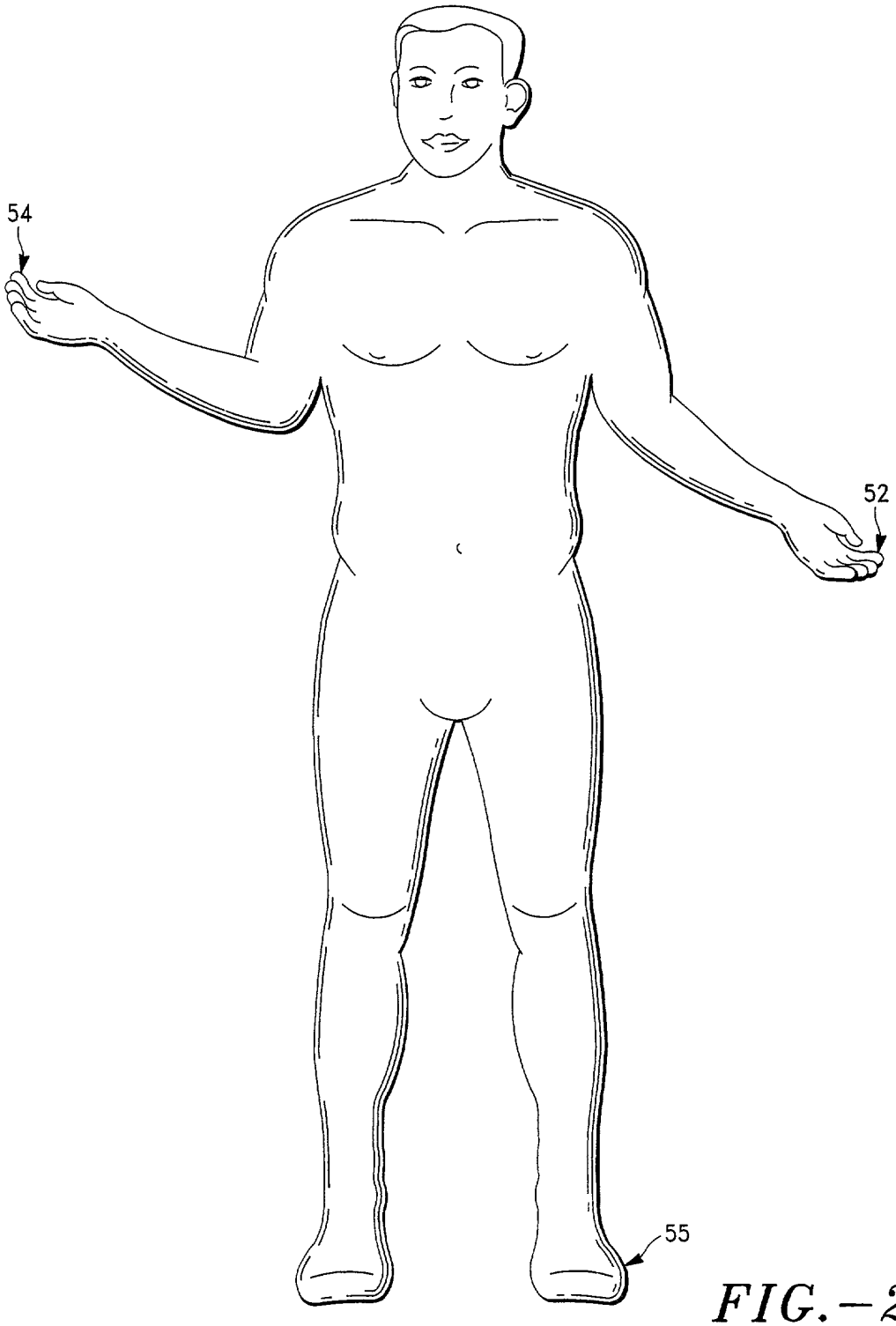


FIG.–21

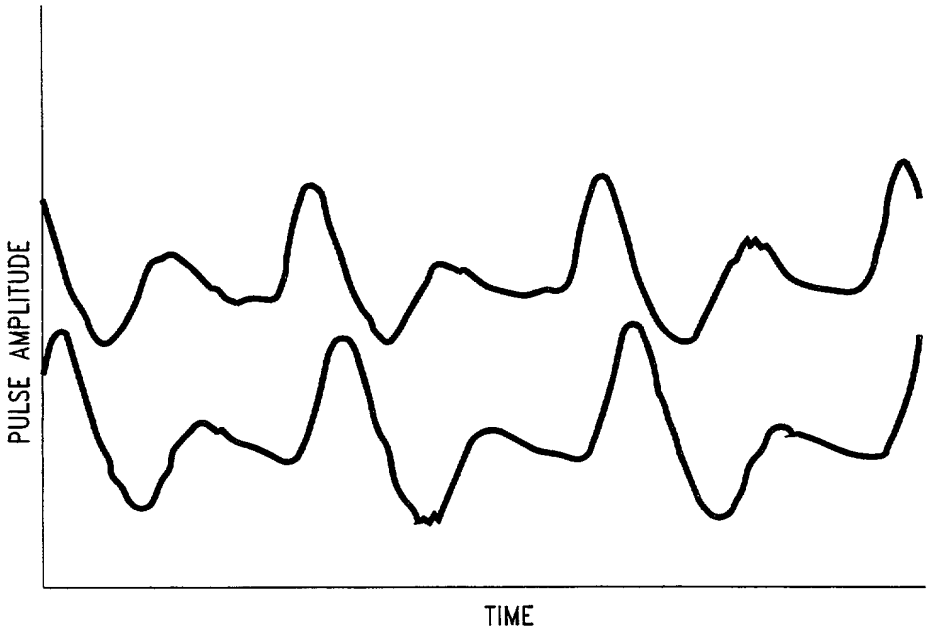


FIG.–22

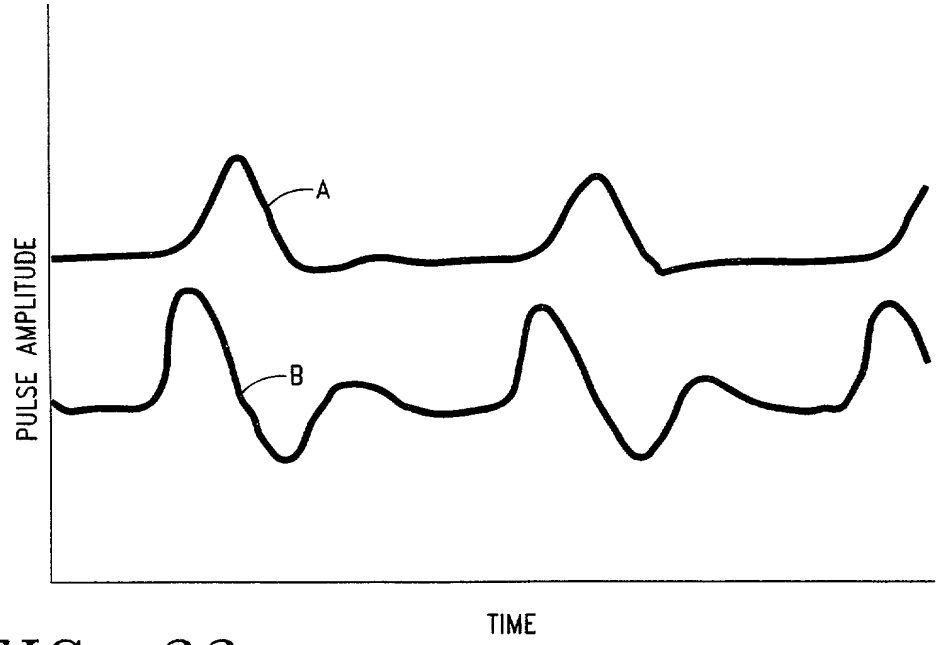


FIG.–23

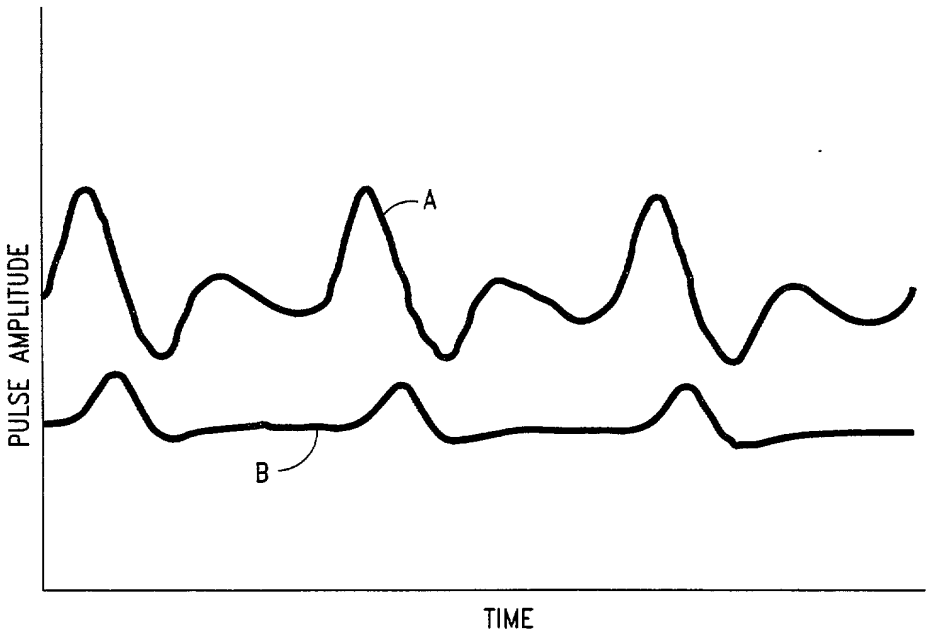


FIG.–24

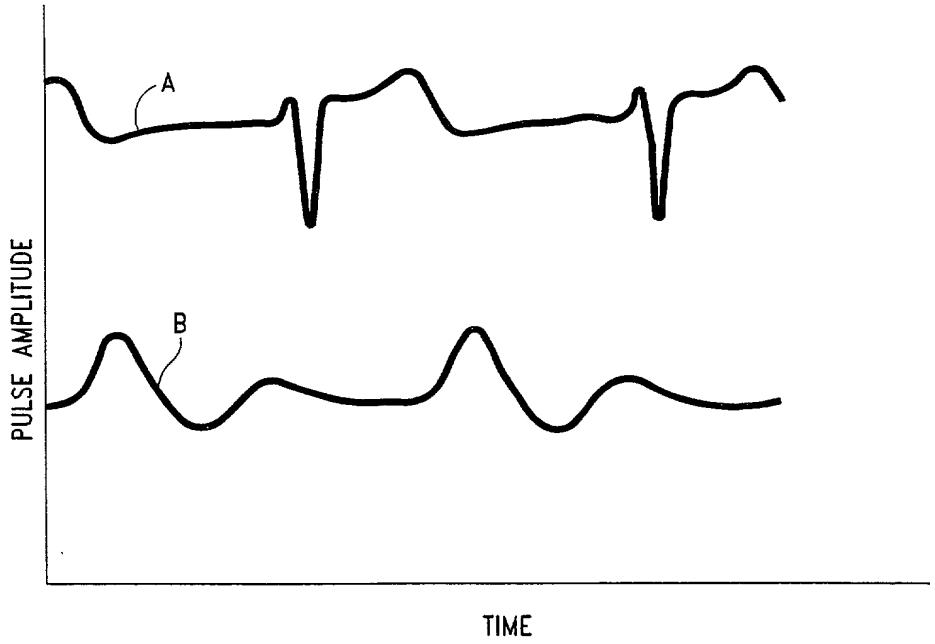


FIG.–25

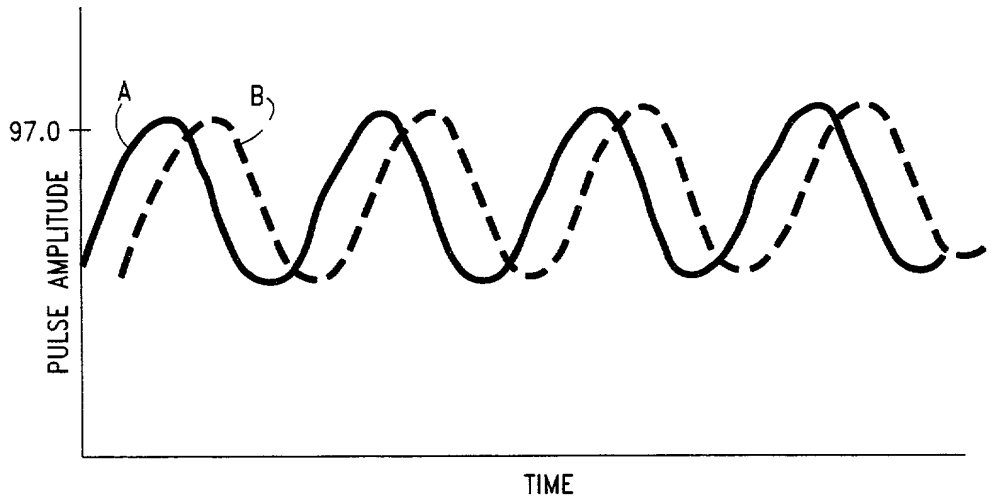


FIG.–26

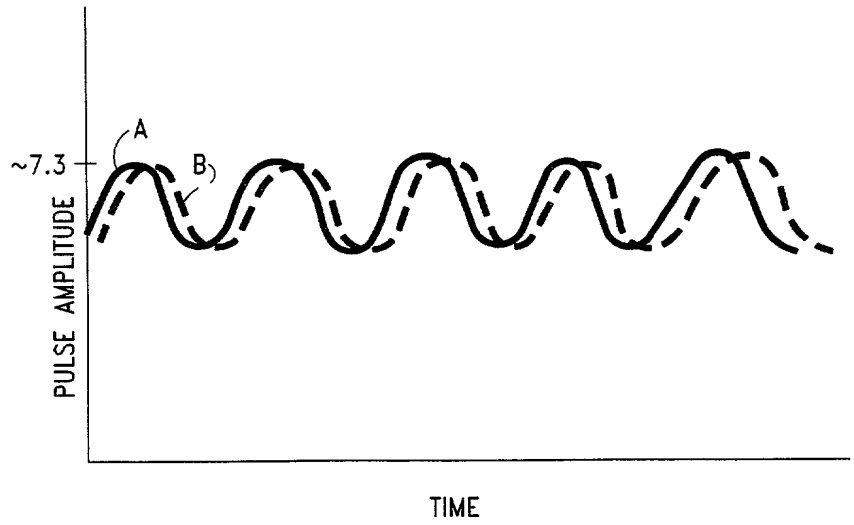


FIG.–27

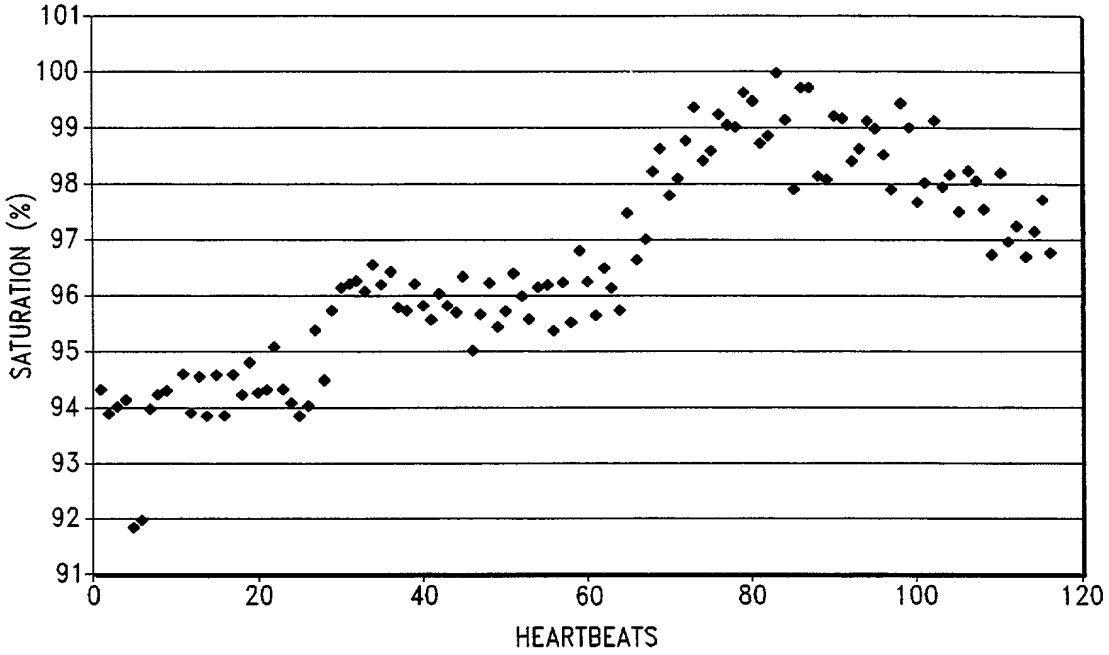

101
100
99
98
97
96
95
94
93
92
91
SATURATION (%)
0
20
40
60
80
100
120
HEARTBEATS

FIG.–28

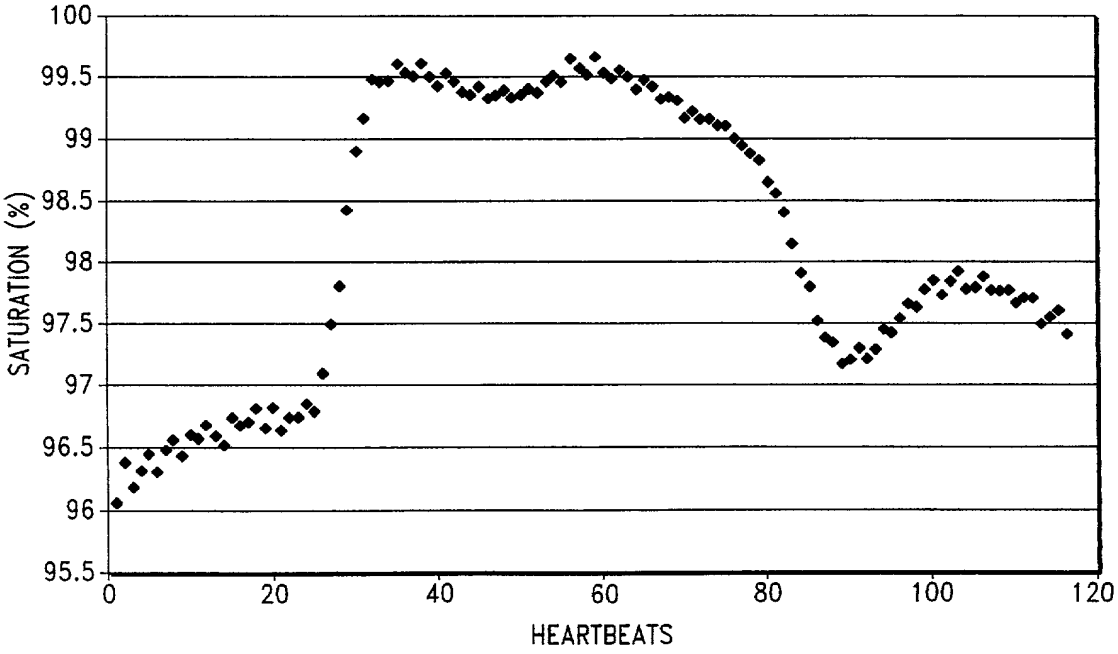

100
99.5
99
98.5
98
97.5
97
96.5
96
95.5
SATURATION (%)
0
20
40
60
80
100
120
HEARTBEATS

FIG.–29

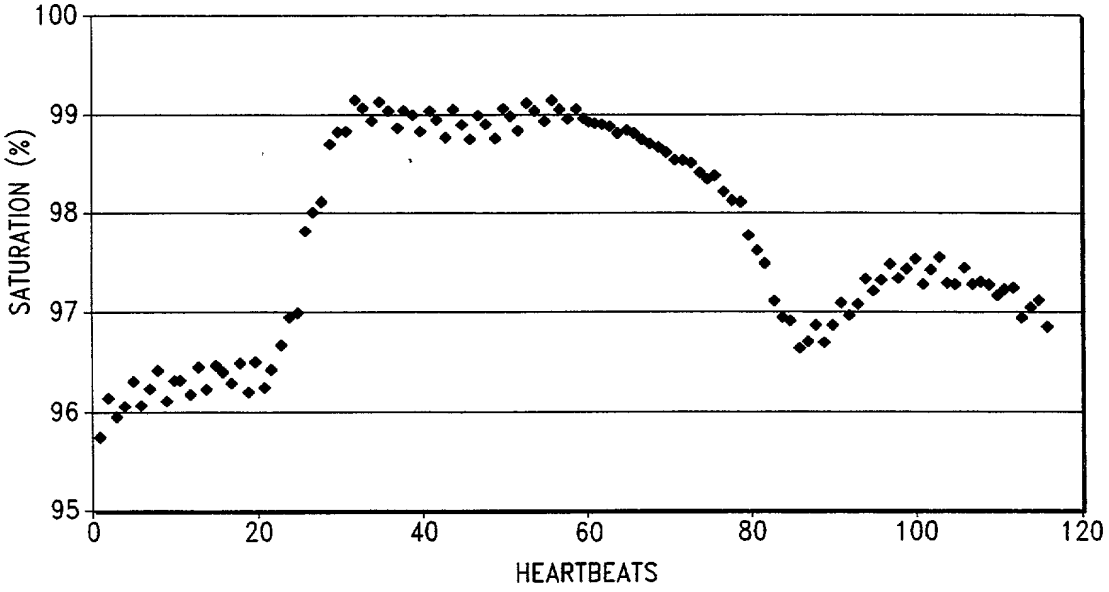

100
99
98
97
96
95
SATURATION (%)
0
20
40
60
80
100
120
HEARTBEATS

FIG.–30

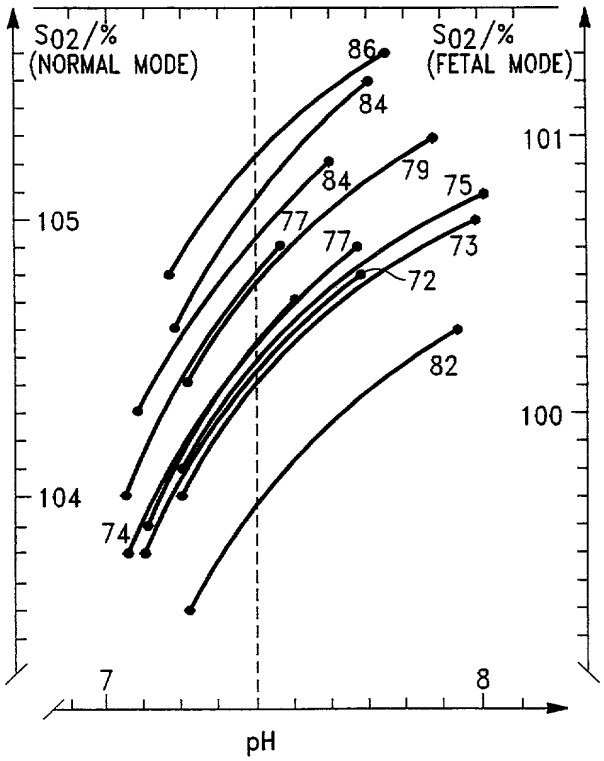

SO2/%
(NORMAL MODE)
SO2/%
(FETAL MODE)
86
84
84
79
75
77
77
73
72
82
105
104
101
100
74
7
8
pH

FIG.–31

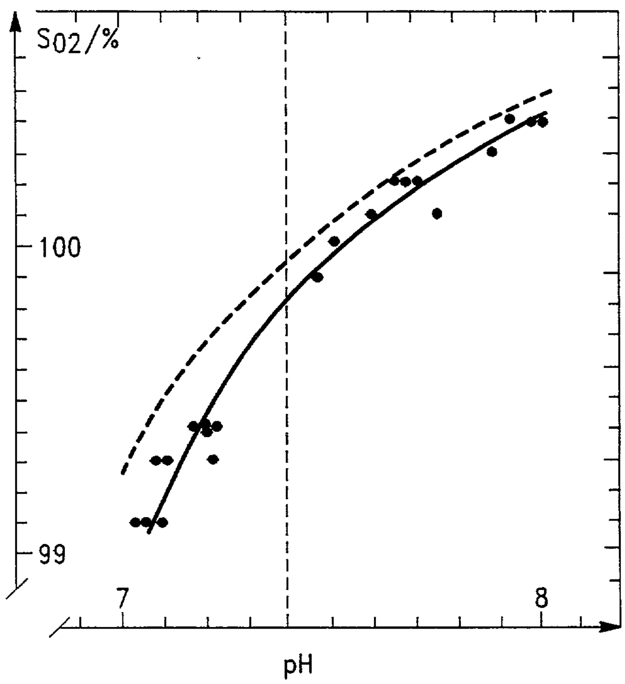

S02/%
100
99
7
8
pH

FIG.−32

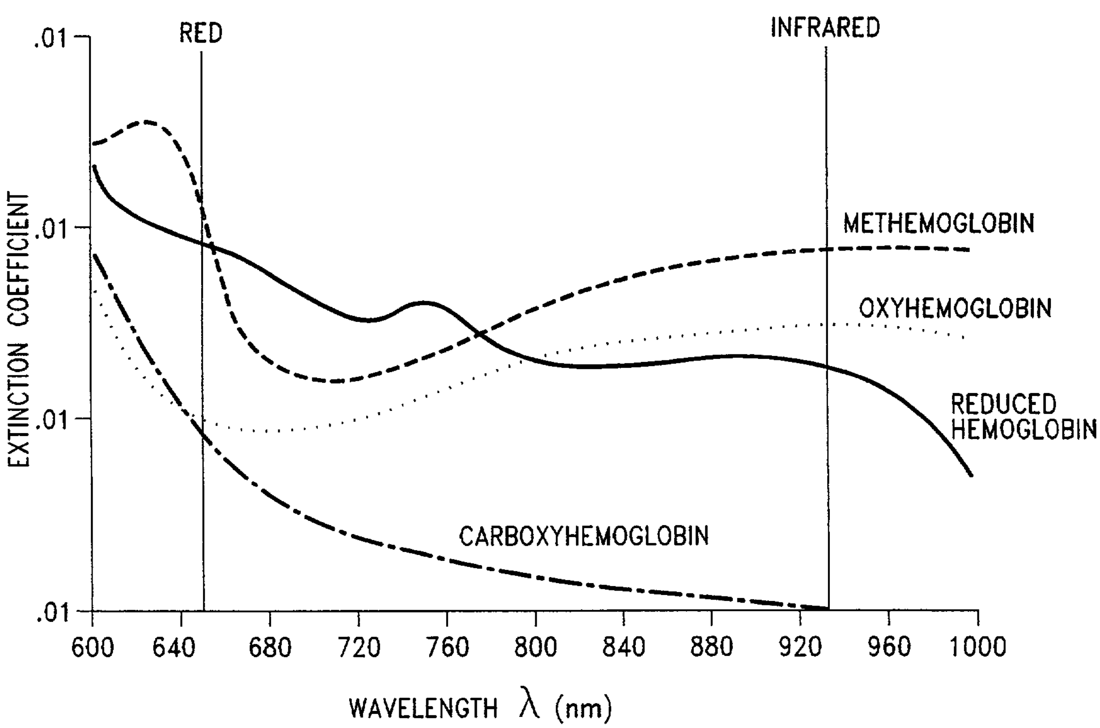

RED
INFRARED
.01
.01
.01
.01
EXTINCTION COEFFICIENT
METHEMOGLOBIN
OXYHEMOGLOBIN
REDUCED HEMOGLOBIN
CARBOXYHEMOGLOBIN
600 640 680 720 760 800 840 880 920 960 1000
WAVELENGTH λ (nm)

FIG.−34

Computational Algorithm for Determination of Hemoglobin Concentration

```
C       A  is the measured absorbance
C       A1  is the absorbance after dividing out extinction coefficients
C       and correcting for saturation
C       A2,A3, ... will be the absorbances at different path lengths,
C       created by multiplying by constants
C       A1,A3, ... and L2,L3, etc.
        constant M2=0.9
        constant M3=0.8
        constant M4=0.7
        constant M5=0.6
        constant M6=0.5
        constant M7=0.4
        constant M8=0.3
C
C       read in the value for hemoglobin absorbance and a value k
C       representing the extinction coefficient for the wavelength and
C       the oxygen saturation
        Begin
        Read, A
        Read, k
        A1:=A/k
        A2:=A1*M2
        A3:=A1*M3
        A4:=A1*M4
        A5:=A1*M5
        A6:=A1*M6
        A7:=A1*M7
        A8:=A1*M8
C
        k1234 = log(A1) * log(A2) - log(A3) * log(A4)
        k5678 + log(A5) * log(A6) - log(A7) * log(A8)
        kd:=[ log(A1*A2) - log(A3*A4) ] / [ log(A5*A6) - log(A7*A8) ]
C
C       combine all the A terms that occur as coefficients,
        kAc := log(A2/A1) - log(A3/A1) - log(A4/A1) - [(kd * log(A5/A1)] -
              - [kd * log(A6/A1) + [kd * log(A7/A1)] + [kd * log(A8/A1)]
C
C       combine all the A terms that occur alone
        kAa :=- [log(A3/A1) * log(A4/A1)] ) -
                    - kd * [log(A5/A1) * log(A6/A1)] +
                    + kd* [(log(A7/A1) * log(A8/A1)]
C
C       k1234 - ( kd * k5678) = kig(L) * kAc + kAa
C       log(L) = [k1234 - (kd * k5678) - kAa] / kAc
C       L = antilog{[k1234 -(kd * k5678) - kAa] / kAc}
C       use EXP or antilog function
        L = EXP([k1234 - (kd * k5678) - kAa] / kAc)
C       L is the path length
C       C is the concentration of hemoglobin
        C = A1 / L
C
        END
```

FIG.—33

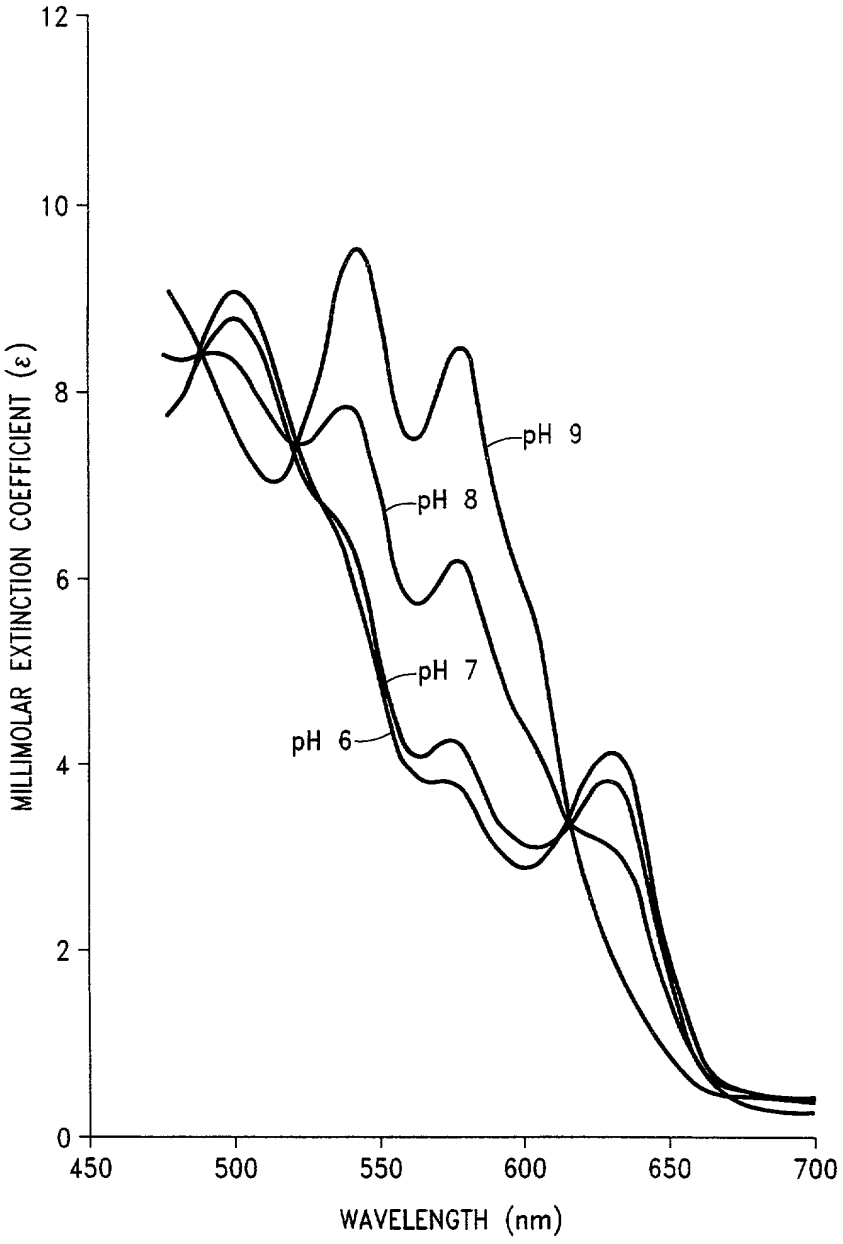

12
10
8
6
4
2
0
MILLIMOLAR EXTINCTION COEFFICIENT (ε)
450
500
550
600
650
700
WAVELENGTH (nm)
pH 9
pH 8
pH 7
pH 6

FIG.–35

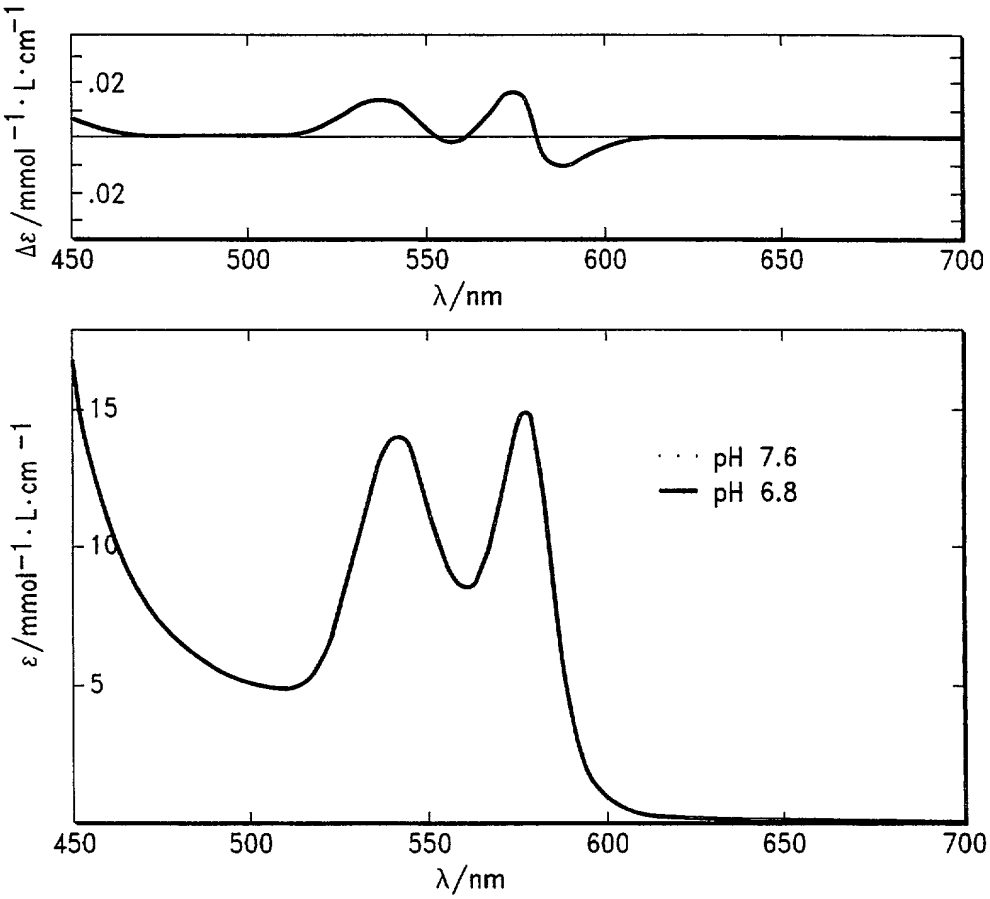

Δε/mmol⁻¹·L·cm⁻¹
.02
.02
450
500
550
600
650
700
λ/nm
ε/mmol⁻¹·L·cm⁻¹
15
10
5
pH 7.6
pH 6.8
450
500
550
600
650
700
λ/nm

FIG.–36

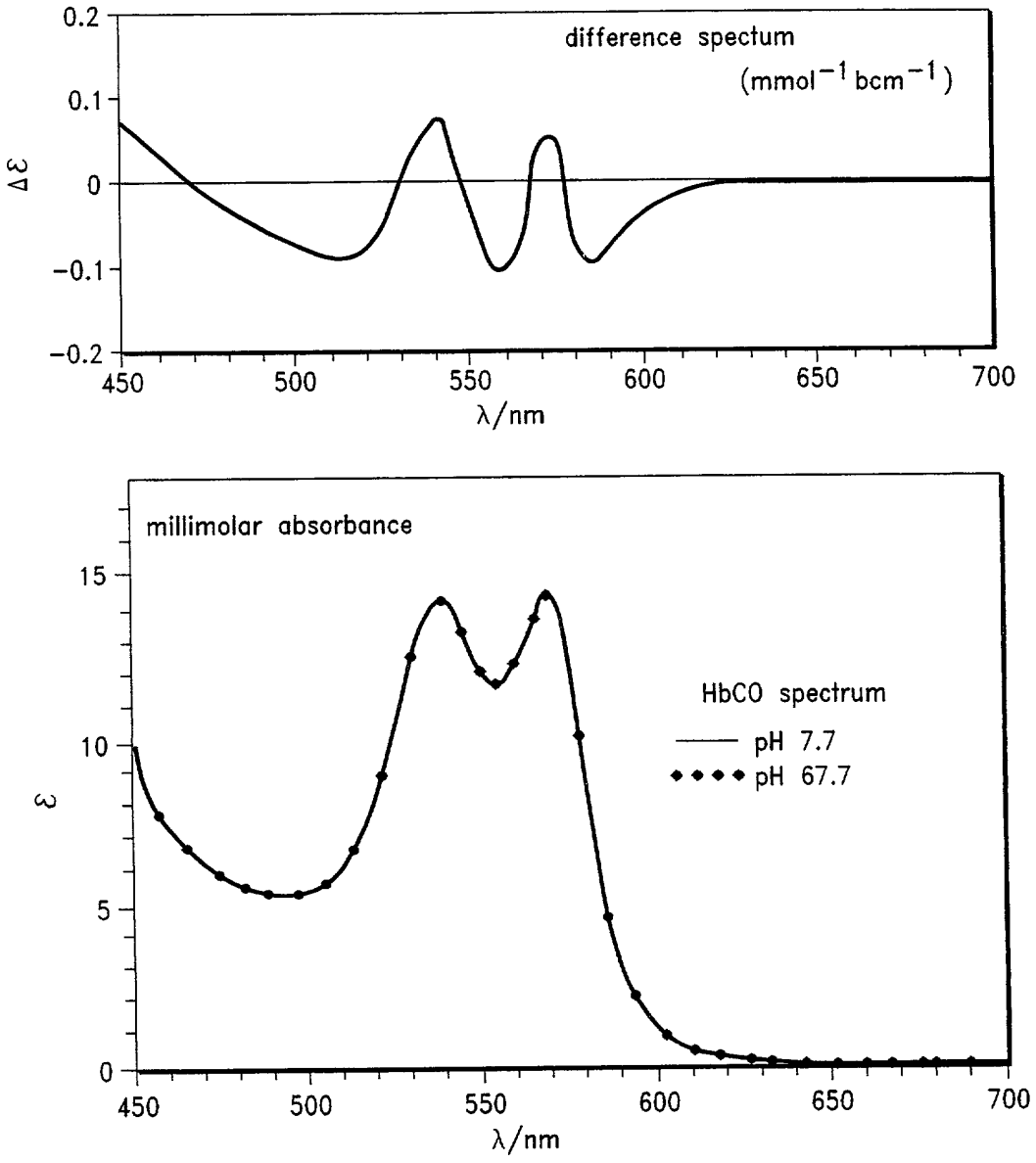
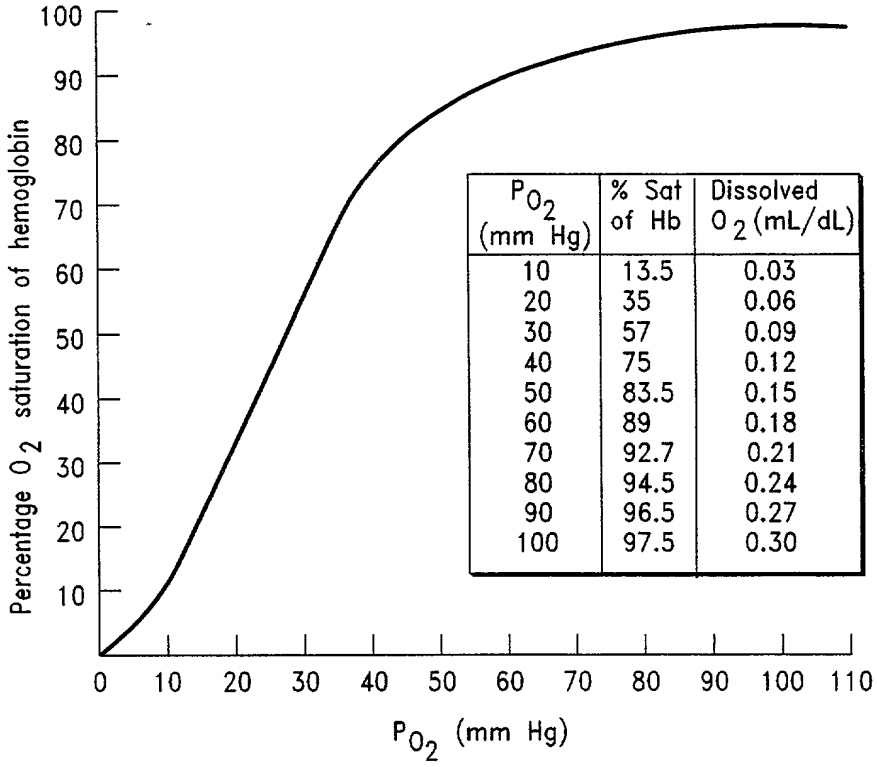

difference spectum
(mmol^{-1} bcm^{-1})
0.2
0.1
0
−0.1
−0.2
Δε
450
500
550
600
650
700
λ/nm
millimolar absorbance
HbCO spectrum
pH 7.7
pH 67.7
15
10
5
0
ε
450
500
550
600
650
700
λ/nm

FIG.–37



P_{O_2} (mm Hg)	% Sat of Hb	Dissolved O_2 (mL/dL)
10	13.5	0.03
20	35	0.06
30	57	0.09
40	75	0.12
50	83.5	0.15
60	89	0.18
70	92.7	0.21
80	94.5	0.24
90	96.5	0.27
100	97.5	0.30

FIG.–38

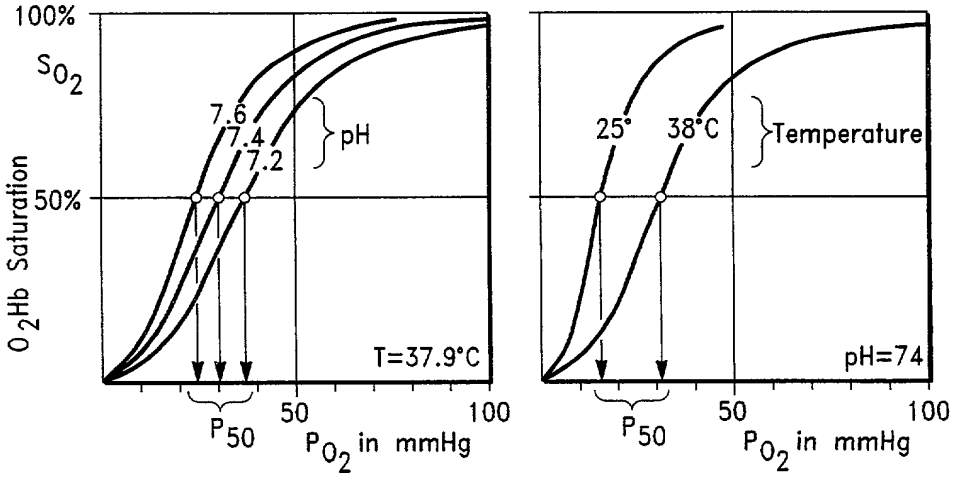


FIG.–39

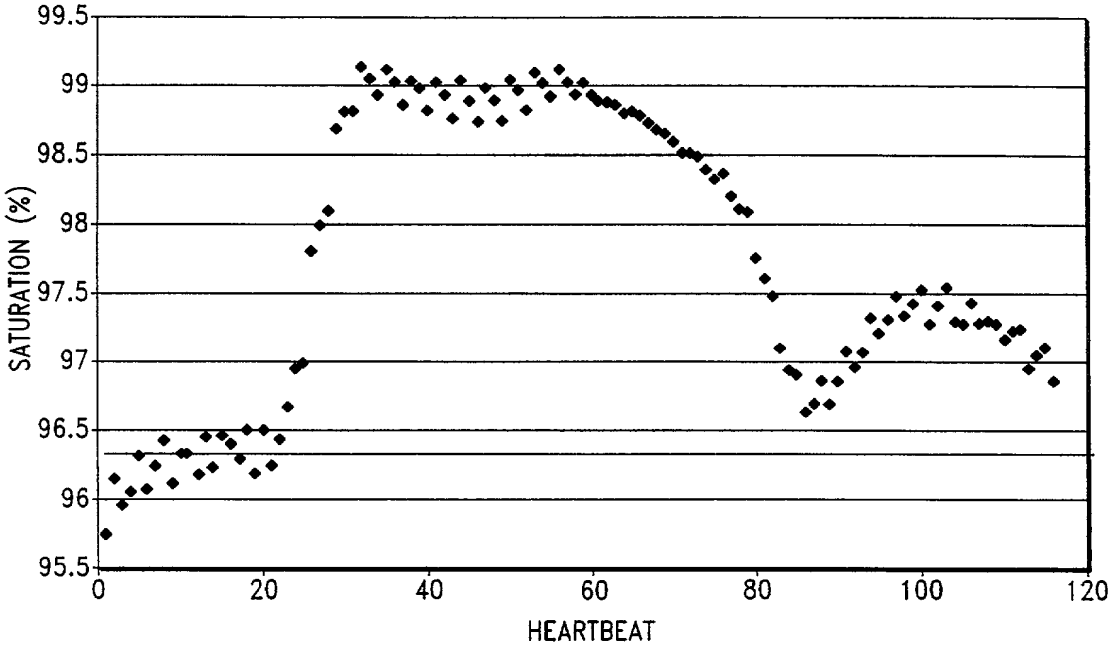

99.5
99
98.5
98
97.5
97
96.5
96
95.5
SATURATION (%)
0
20
40
60
80
100
120
HEARTBEAT

FIG.—40

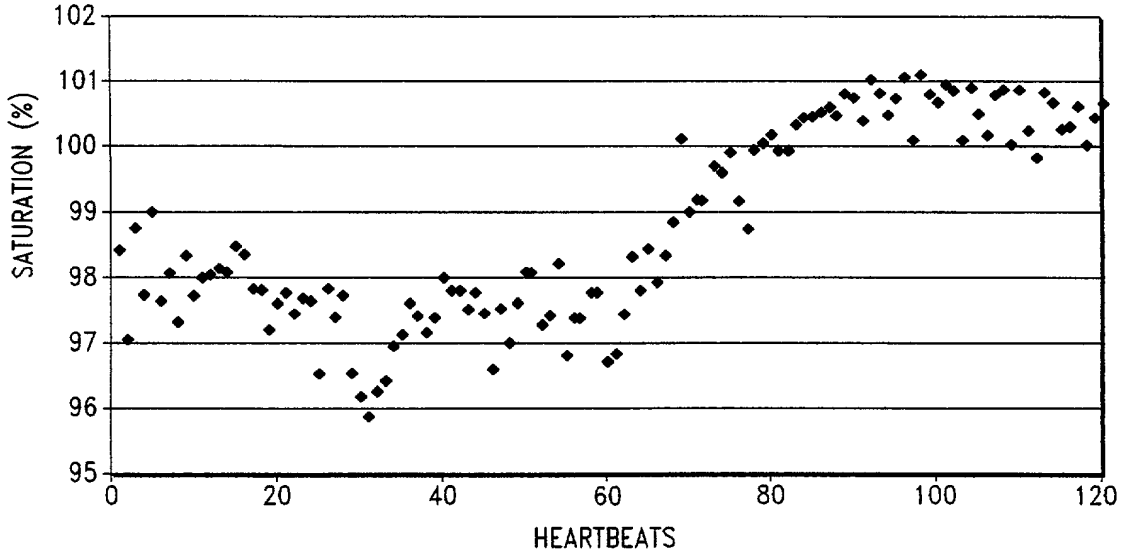

102
101
100
99
98
97
96
95
SATURATION (%)
0
20
40
60
80
100
120
HEARTBEATS

FIG.—41